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Gross-Wen Technologies: Using Algae to Clean City Sewage

A pioneering enterprise formed to treat municipal and industrial wastewater with algae hopes to launch into large-scale operation this summer with construction of its first functional, city-sized test facility in Dallas Center, Iowa.

Gross-Wen Technologies, a company launched by Iowa State University researcher Martin Gross and professor Zhiyou Wen, has been working for roughly two years on plans to turn its discoveries into a two-pronged business. The Gross-Wen approach uses tanks of wastewater, vertical conveyor belts, and a special biofilm to grow and harvest

the algae. Once water treatment is complete, the algae can be scraped off the belts and sold as a fertilizer, effectively subsidizing the cost of running a large-scale treatment system.

Darren Jarboe, an Iowa State program manager who also serves as vice president of business development

for Gross-Wen, said the technology eventually could find a place in everything from spot contaminant treatment at water-heavy industrial businesses to drinking water purification for Iowa cities concerned about incoming nitrates. Markets are still being explored as the technology matures and a business begins.

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On the Cover: Martin Gross and Zhiyou Wen examine treated wastewater.

CIRAS Mission: *Every day we will enhance the performance of industry through applied research, education, and technical assistance.*

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"There are a lot of potential potholes for us to hit along the way," Jarboe said. "We know some of them, but we're probably going to hit others as we go."

Gross said research done both in Iowa State labs and on six pilot-scale systems set up as part of a test project for the city of Chicago shows that algae is roughly 10 times more effective than traditional methods at removing major contaminants from water.

"Essentially, what we're doing in the whole process is we're taking the nitrogen and phosphorus from where they're polluting water, and we're moving them to where they're actually needed," Gross said.

Algae production is only a side benefit of the process, however.

The primary advantage for Brian Slaughter, Dallas Center public works director, is the possibility of holding costs low while still responding adequately to a state mandate that his city do more to remove ammonia and nitrates from its wastewater. Slaughter said small communities across Iowa are facing similar deadlines to improve their aging lagoon treatment systems, which often have difficulty performing adequately in cold weather.

Dallas Center operates its wastewater treatment system on a four-year permit from the state Department of Natural Resources. Slaughter said the city needs to have improvements in place by 2020.

"The algae is very promising," he said. "If it could hold our costs down, that's awesome. We've got 1,623 people here. If you start building a \$5 million treatment plant, that's a tough one for our residents to pay out of their water bills."

The next step for Gross-Wen is to manufacture and install a larger version of its system. The company hopes by the end of this summer to start construction of its first city-sized treatment facility in Dallas Center. The plant initially would be owned and operated by Gross-Wen as a test site.

Dallas Center city council members discussed the idea for the first time in January, sounding intrigued but wary of still-unanswered questions—such as the price and whether or not there's time for the algae system to win state regulatory approval before the city permit runs out.

Gross, Wen, and Jarboe see Dallas Center, if all goes well, as something that could be replicated throughout Iowa and the rest of the Midwest. In smaller versions, the technology has already proven to be adept at cleaning localized wastewater issues. CIRAS spent 2016 working with Gross-Wen to test the company's process and helped connect researchers with a handful of water-heavy industrial businesses in need of specific wastewater treatment assistance.

One was CJ Bio America, an animal feed supplement company that tested Gross-Wen's process for removing nitrogen from water.

"Environment-friendly solutions such as this are not only critical to our success as an ecofriendly company, they are necessary for a long-term, sustainable, and

"Essentially, what we're doing in the whole process is we're taking the nitrogen and phosphorus from where they're polluting water, and we're moving them to where they're actually needed."
— Martin Gross



The algae treatment system currently exists in a smaller, mobile form (bottom) and in a greenhouse on the Iowa State campus.

healthy earth for future generations,” said senior operations manager Luke Palmer. “We look forward to continued collaborations.”

Companies like Gross-Wen could provide an important service to manufacturers, according to CIRAS program director Mike O’Donnell, because they offer the possibility of an interim solution for businesses that have grown beyond the limits of their existing wastewater-cleansing technology.

State regulatory permits for manufacturers who capture their own pollutants are based on capacity, O’Donnell said, and “we know there are Iowa manufacturers whose growth is limited by water discharge issues.”

More broadly, CIRAS account manager Brenda Martin calls Gross-Wen “a really good example of how research moves toward commercialization.”

The Iowa State researchers “were looking for an efficient way to grow algae as a fuel source, and they discovered that the algae was an efficient way to clean the water and take some nasty stuff out,” Martin said.

“Environment-friendly solutions such as this are not only critical to our success as an ecofriendly company, they are necessary for a long-term, sustainable, and healthy earth for future generations.”

— Luke Palmer

“CIRAS really helped them connect with the right industries. . . . We got jars of sewage from companies, and they tried it in the Department of Food Science and Human Nutrition. They then brought more to the BioCentury Research Farm (near Ames) and ran the system for several days.”

Gross said work on the technology itself is largely complete. The Chicago tests, which involved a series of conveyor belts ranging between 3 and 6 feet tall, seem to have established that larger is more efficient. The belts allow algae to prosper in the sun and air while simultaneously making it easier to harvest.

“We weren’t the first people who have ever thought of using algae for water treatment, but we believe that our algae-growing system is the best algae system that’s been developed so far,” Gross said. “Basically what we’re doing with Chicago is showing that it’s feasible.”

The remaining task is turning the system into a product. The Dallas Center treatment plant, if built, would be owned and operated by Gross-Wen for a while

in an attempt to win formal licensure from the Iowa Department of Natural Resources. If all goes as planned, the city eventually would purchase the plant and run it as an add-on to Dallas Center’s traditional sewage treatment operation.

Gross, Wen, and Jarboe believe the technology eventually may make sense for water plants, as well as wastewater treatment facilities—although capacity may remain an issue for large communities.

“Right now, we are focusing on small communities,” Wen said. “But our technology is flexible.”



➤ For more information, contact Brenda Martin at bkmartin@iastate.edu or 515-570-5282.

'Year of Manufacturing' Initiative Seeks to Boost Manufacturing GDP

Iowa industry experts have launched a yearlong planning effort to help the state find new ways to reach out to manufacturers, get them the help they need, and generate significant growth in Iowa's manufacturing gross domestic product (GDP) within the next five years.

Led by the Iowa Economic Development Authority (IEDA) and the Iowa Innovation Corporation (IIC), the effort was publicly announced in January as part of Gov. Terry Branstad's Condition of the State address. The "Year of Manufacturing" initiative has a goal of boosting Iowa's workforce, innovation, and overall competitiveness so that industry will grow in Iowa and become a larger portion of the state's economy.

CIRAS director Ron Cox said the center will assist in any way it can to boost Iowa manufacturing and make Iowa communities stronger.

Iowa's 6,100 manufacturing businesses account for a combined 18 percent of the state's economy. But manufacturing GDP nevertheless was flat from 2005 through 2015.

"One-quarter of Iowa manufacturers are doing very well right now," said CIRAS program director Mike O'Donnell. "The rest need a little help. One of our focuses for 2017 is going to be helping that other 75 percent get ready for the world that's coming."

Axel Innovation, a consulting firm hired last year by the IEDA, has called for increased networking among Iowa manufacturers to help firms find assistance with specific problems.

CIRAS will continue working with the IEDA, the IIC, and the Iowa Association of Business and Industry, among others, to find ways to make those recommendations a reality. At the same time, Cox has been chosen to serve on an IIC committee developing the set of leading indicators that will be used to measure future improvement in the manufacturing economy.

Plans call for the IIC to develop "key strategies to assist Iowa manufacturers to stay on the cutting edge of their industries" and present it all to the governor by November 30.



"One-quarter of Iowa manufacturers are doing very well right now. The rest need a little help. One of our focuses for 2017 is going to be helping that other 75 percent get ready for the world that's coming."
— Mike O'Donnell

CIRAS Wins Renewal as Iowa Affiliate for Manufacturers Extension Partnership

Iowa manufacturers are poised to receive up to \$37 million in research-based, business-improving services over the next 10 years after U.S. Department of Commerce officials decided to renew the department's long-standing relationship with CIRAS.

In January, CIRAS was awarded a new five-year agreement continuing the center's role as Iowa affiliate for the National Institute for Standards and Technology's (NIST) Manufacturers Extension Partnership (MEP). CIRAS has operated the MEP program in Iowa since 2005 and won the new five-year contract following a statewide competition.

The award provides nearly \$9.3 million over the next five years, which CIRAS will match with state and university money to create a five-year program budget of roughly \$18.6 million. A five-year extension is likely if CIRAS continues to perform well in the eyes of MEP officials.

"This decision is MEP's expression of confidence in CIRAS," said Mike O'Donnell, CIRAS' director of the MEP program. "Change is coming to the U.S. manufacturing industry, and many Iowa companies still need to get ready for it. CIRAS is focused on helping them not only to survive the changes, but to thrive."



CIRAS Helps Frog Legs Make Smooth Slide into Carbon Fiber Wheelchair Wheels

An Iowa manufacturer of wheelchair wheels and caster forks has begun selling stronger and lighter versions of those products—thanks partly to CIRAS’ help in testing and refining what the company describes as “the world’s first carbon fiber wheel set.”

Ottumwa-based Frog Legs Inc., which has sold aluminum wheelchair wheels and suspensions since 1997, began selling a new carbon fiber version of its products earlier this year.

Owner Mark Chelgren said the company figured out how to save “30 percent off the weight of our original products, and we’ve almost doubled the strength” by including carbon fibers in the plastic injection molding process used to create its new wheels and forks. When compared to aluminum, the change means tougher and more durable wheelchairs that also are much easier to produce.

“Carbon fiber technology has come along to the point where we can do some very intricate, detailed designs now that we couldn’t do before,” Chelgren said. “We could not make the products this way with the strength and the performance that we needed 10 years ago.”

Chelgren said CIRAS “helped us tremendously in testing the process and vetting the way that the products are made.”

CIRAS project manager Shankar Srinivasan helped the company connect with a Minnesota plastics firm that uses a relatively new method of adding carbon fibers to plastic. As a result, Frog Legs achieved the incredible strength of carbon fiber without leaving its main area of manufacturing expertise.

“They already know injection molding like the backs of their hands,” Srinivasan said. “If you’re truly looking for a home run, this method of using carbon fiber would be it for them.”

Wheelchairs first drew Chelgren’s attention in 1994 after he met members of a quadriplegic rugby team and became fascinated with their experiences. Studies show most of the bumps, muscle strain, and back pain inherent in long wheelchair rides come from vibrations transmitted through the front wheels. Frog Legs ultimately designed a new suspension system aimed at absorbing shocks and maintaining stability for the rider.

The switch to carbon fiber “allows us to go to the next step,” he said. “I think in the next two years it will completely replace our existing technology.”

Chelgren acknowledges that Frog Legs is cannibalizing its own business. However, “we’re also obsoleting the products of our competitors.”

Chelgren praised CIRAS for helping Frog Legs perfect the new version and bring it to market.

“CIRAS’ mission in my opinion isn’t really to come up with new products,”

Chelgren said. “It’s to make sure that people who come up with new products have a resource to optimize those products.”



Equipment Manufacturers Induct Iowans into Hall of Fame

Two Iowa entrepreneurs were honored by their industry in November with induction into the Association of Equipment Manufacturers Hall of Fame.

The AEM, an international trade group, honored Ray Hagie, founder of Clarion-based Hagie Manufacturing LLC, and Robert L. Vermeer, chairman emeritus of Pella-based Vermeer Corporation.

According to the AEM Hall of Fame, inductees are chosen annually by a panel of industry experts who evaluate a candidate’s track record for innovation, leadership, social responsibility, and contribution to industry, among other things. Dennis Slater, AEM president, described Hagie and Vermeer as leaders who “contributed significantly to the growth and strength of our industry and economic progress and quality of life around the world.”

Ray Hagie started out as a seller of hybrid seed corn before he brought the world’s first self-propelled sprayer to market in 1947. His company followed with invention of the four-wheeled sprayer, the front-mounted boom, and a high-clearance nitrogen toolbar. Hagie also served in the Iowa Legislature, on the Iowa State University Board of Governors, and as chairman of the Iowa Manufacturers Association.

Bob Vermeer started at his company in 1974, ultimately rising to become CEO and chairman beginning in 1989. Vermeer sales grew nearly 13 times during his tenure, which also included key advancements in finance that made it easier for dealers to stock equipment globally. Vermeer has served as chairman both of AEM and of the Iowa Business Council and held seats on many community boards.

➤ For more information, contact Shankar Srinivasan at srigshan@iastate.edu or 515-290-6702.

Materials Development Lab

CIRAS metallurgist Paul Berge discusses how his team might use various pieces of equipment to photograph (right), test, or analyze different items to answer a company's questions.



CIRAS Lab Tours Showcase Iowa State's Available Expertise

Sometimes, you just want to see what the possibilities are.

That's why CIRAS took steps last year to formalize and expand a long-standing practice of inviting Iowa business leaders to walk through various industry-related labs on the Iowa State University campus. CIRAS now runs four regularly scheduled tours each year so business leaders can see firsthand the rooms where experts test structures, explore materials, and use nondestructive methods to test a host of items. A second tour schedule includes visits to the polymer lab and CIRAS' metal additive manufacturing machine.

"Companies generally walk away from those tours intrigued, and it usually leads to us helping a company with at least one project," said Chris Hill, head of CIRAS' Technology Assistance Program.

Nondestructive Evaluation Lab

Associate scientist Dave Utrata demonstrates how x-rays (left) and sound waves (right) can be used to find interior weakness in metal parts.



Structural Engineering Lab

Associate scientist Douglas Wood explains tests in progress on concrete piles and (right) tests that are possible using a tensile and compression machine.



➤ For more information, contact Chris Hill at chhill@iastate.edu or 515-294-5416.

Iowa Program Helps Companies Afford Some Added Expertise—By Adding Interns

Interns at ALMACO get much more than an overview of the company's custom-built agricultural equipment. They become part of the team.

Brian Carr, ALMACO's vice president of engineering, said student employees at the Nevada-based company get directly involved in completing projects—from initial design, through problem-solving challenges, to the eventual result.

"We ask them to participate in every aspect of the development of a product," Carr said. "It's all collaborative engineering, and they're just one more voice in the game."

Businesses long have viewed internships as a valuable way to add those fresh voices, said CIRAS account manager Derek Thompson, but not everyone has the budget to fully fund intern programs. A grant program offered through the Iowa Economic Development Authority (IEDA) seeks to change that by providing matching money to help small- and medium-sized Iowa businesses such as ALMACO take their first dips into the student talent pool.

Grants are open to businesses in advanced manufacturing, biosciences, and information technology. The program is beneficial, Thompson said, in that it directly provides money to cover up to one-half the cost of interns' pay.

Seeding interns into smaller Iowa companies may eventually prove essential to filling permanent manufacturing jobs, Thompson said. Otherwise, "how do you identify and attract engineers to towns of less than

5,000 people, less than 10,000 people?"

Thompson said he makes it a priority to educate clients about the grants. "I actively promote that program daily."

Iowa State had 114 interns (including 80 engineering majors) covered by the program between fall 2015 and summer 2016.

"Iowa State is definitely the school with the most student interns in the program

"Iowa State is definitely the school with the most student interns in the program around the state. Iowa State University College of Engineering students are the most highly recruited interns by the employers that use our program."
—Jennifer Meier

around the state," said Jennifer Meier, IEDA program manager. "Iowa State University College of Engineering students are the most highly recruited interns by the employers that use our program."

Stellar Industries, Inc., a Garner-based company that produces hydraulic truck equipment, has

participated in the state program since 2000, said human resources manager Leanne Van Oort.

"Interns have worked in groups as well as on individual projects within our departments, mainly within our manufacturing engineering and mechanical engineering departments, but also the purchasing and supply chain management departments," she said.

Stellar frequently hires its interns for full-time jobs, Van Oort said—as does ALMACO.

"The more contact we can have with students, in a positive light like that, the better off we are," Carr said.

Iowa Student Internship Program

Qualifying companies in the fields of advanced manufacturing, biosciences, and information technology may receive matching grant money from the state to offset interns' wages. Financial support is available for semester-length internships and also during the summer. Interns are chosen by the company and can come from any college or university (although out-of-state students must have graduated from an Iowa high school).

FY 2016

(Fall 2015, Spring and Summer 2016)

IOWA STATE:

114 (80 engineering students)*

UNIVERSITY OF IOWA:

42 (29 engineering students)*

UNIVERSITY OF NORTHERN IOWA:

17 (4 engineering students)*

ALL OTHERS: 69

FY 2015

(Fall 2014, Spring and Summer 2015)

IOWA STATE:

119 (69 engineering)

UNIVERSITY OF IOWA:

32 (18 engineering)

UNIVERSITY OF NORTHERN IOWA:

8 (3 engineering)

ALL OTHERS: 77

FY 2014

(Fall 2013, Spring and Summer 2014)

IOWA STATE:

75 (42 engineering)

UNIVERSITY OF IOWA:

33 (28 engineering)

UNIVERSITY OF NORTHERN IOWA: 0

ALL OTHERS: 110

*Iowa State and Iowa both have Colleges of Engineering; UNI's numbers include majors in that school's Electrical Engineering Technology program.

➤ For more information, contact Derek Thompson at thompson@iastate.edu or 515-419-2163 or visit www.iowaeconomicdevelopment.com/WorkforceTraining/student.

Puck Custom Enterprises Finds Reassurance in ExporTech, Extra Profits Overseas

Puck Custom Enterprises never intended to venture into Eastern European commerce. But then a booming Croatian pork industry led to a request for the company's help.

"In 2006, we met some guys through Iowa State University who were from Croatia and who were over here studying pork production," said Jeremy Puck, the Manning, Iowa-based company's sales manager. "It turns out, one of the biggest troubles they were having was manure application."

Puck Custom Enterprises was founded in 1979 as a manure application business. In 2005, the company began to manufacture its own equipment—the PCE Hose Cart.

The few exports that began flowing in 2006 eventually led to strong overseas contacts and a new manufacturing plant. Puck's revenue from exports more than doubled between 2011 and 2016. The company now sells in Croatia, Ukraine, Russia, and Romania, and "we'll probably be in Serbia soon," Jeremy Puck said.

"Our whole business overseas is just running into the right people and building on them," he said. "We're very fortunate that way."

The rising revenue trajectory for Puck comes partly after the company expanded its connections in 2014 through participation in ExporTech, a three-part educational program developed by the U.S. Department of Commerce. It's deployed locally by CIRAS, Iowa's U.S. Commercial Services office, the Iowa Economic Development Authority, and other CIRAS partners. Classes involve hands-on sessions with a handful of companies each year that sit with experts to craft individual plans for marketing and selling their products overseas.

"Most companies want to export, but they find it kind of intimidating," said Marc Schneider, CIRAS project manager. "I think the biggest obstacle is they don't know what to do. They don't know where to start."

Jim Riffel, director of the satellite business group at Winegard Co., a TV and satellite antenna manufacturer in Burlington, said his company found ExporTech to be "a good program" when officials completed it last year. "We've



identified a couple of new markets, and we're now trying to pursue those areas," Riffel said.

"I think it helped just interacting with people," he said. "We got a lot of information from the people who were involved."

Jeremy Puck said the ExporTech sessions essentially reassured his firm that Puck employees were stumbling in the correct direction. The company's periodic difficulty with foreign paperwork and having products get trapped in overseas ports were common headaches, Puck employees learned.

ExporTech "didn't really change how we do things today, but it opened us up to a lot of different networking," Puck said. "So if we do have troubles, we know now who to turn to for help."

➤ For more information, contact Marc Schneider at maschn@iastate.edu or 563-221-1596.

Above: Puck equipment packed for shipment overseas. **Below:** Two Croatian Puck employees talk to a Danish farmer (middle) who operates in the Ukraine.





Experts work to improve the TSB process at a Lean Mapping Event in 2016.

CIRAS Assisting Effort to Improve Iowa's Targeted Small Business Program

Iowa officials are working to streamline and improve a state preference program for small businesses to make it easier to understand and quicker for companies to access.

Iowa's Targeted Small Business (TSB) program provides purchasing preferences for designated Iowa companies that are owned and managed by women, minority group members, service-disabled veterans, or people with disabilities. Program oversight formerly was split between two different state agencies, but control was consolidated under the Iowa Economic Development Authority (IEDA) beginning last September.

Work to improve the TSB program actually began in May 2016, with a weeklong Lean Mapping Event that included CIRAS, which regularly counsels companies about preference programs that might make them more competitive. Since that meeting, program officials say the time between application and acceptance or denial now averages less than a week, compared to times that previously ran as long as 30 days.

Jill Lippincott, the new TSB program manager, said improvements are broad and ongoing.

"In addition to a streamlined application process, we've added benefits to the program that will help connect Targeted Small Businesses with other opportunities and partners that can help them grow their businesses," she said.

Targeted Small Businesses now get access to *Bullseye*, a quarterly newsletter that discusses program updates and profiles companies and agencies involved in the program. Participating businesses also get invitations to workshops and events hosted by IEDA and its partners, and a new TSB badge has been created for the designated firms to use in marketing materials.

CIRAS government contracting specialist Beth White, who continues to assist with TSB improvement efforts, sees potential on the horizon.

"Many companies seem to have been confused about the true benefits of the TSB program, and as a result, many left or did not take full advantage of the certification," White said. "With new leadership and new enthusiasm, this program now seems on track to become a robust part of Iowa government, assisting businesses and offering multiple opportunities to grow."

➤ **For more information, contact Beth White at whiteb@iastate.edu or 563-370-2166.**

New CIRAS Advisory Council Members

Sherry Becker is executive director of NIVC Services Inc., a nonprofit based in Mason City that provides job placement to individuals with disabilities through its coffee shop, thrift stores, and manufacturing-related divisions. NIVC was named one of the 150 Top Workplaces in Iowa in 2015 and 2016. Becker holds a bachelor's degree in social work from the University of Iowa and a master's degree in rehabilitation counseling from Drake University.



Sherry Becker

Martina Bockenstedt is general manager of Engineering Services and Products Company in Dyersville. Her expertise is in the areas of customer service, sales, marketing, business planning, and project management.



Martina Bockenstedt

Bockenstedt holds a bachelor's degree in marketing from the University of Northern Iowa. She serves as chair of the Dyersville Health Foundation and is a Dyersville Economic Development Corporation board member. She was named a Dubuque Area Rising Star in 2015 and was a Dyersville Woman of the Year nominee in 2016.

Ryan DeBarr is president and chief operating officer of MiracleTools America LLC in Davenport. The company manufactures solid carbide cutting tools and is a joint venture of Mitsubishi Materials Corporation in Tokyo and M. A.



Ryan DeBarr

Ford Manufacturing Company in Davenport. DeBarr received his bachelor's degree in industrial technology from Iowa State University and a master's degree in business administration from Saint Ambrose University.

Looking for Clues to Competitiveness in Iowa's Manufacturing Wages

by Liesl Eathington

Wage levels both reflect and influence the competitiveness of Iowa's manufacturing sector. The average manufacturing worker in Iowa earned \$42,470 in 2015, about 86 percent of the national average. Accounting for Iowa's lower cost of living improves the picture, boosting the state's pay on a price parity basis to 95 percent of the U.S. average.

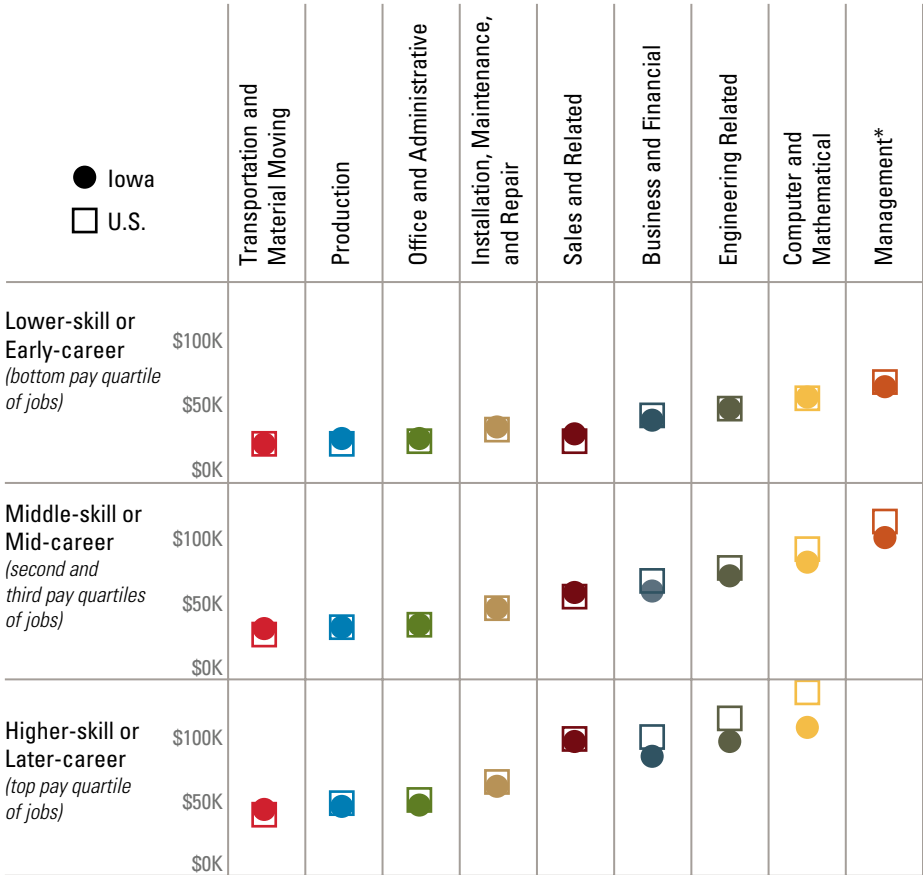
The pay differential* for Iowa's manufacturing workers varies by the type of work they perform. Iowa's average production worker, for example, earns 104 percent of the average U.S. production worker's wage. Iowa's engineering-related workers average just 90 cents for every dollar earned by their national peers.

This article demonstrates how closer attention to wage distributions might inform the state's innovation and workforce attraction/retention efforts. For our example, we classify Iowa and U.S. manufacturing jobs along two dimensions: occupation and inferred skill or experience level. Nine occupational groups are considered, which together account for 95 percent of all manufacturing jobs.

Assuming that pay levels are commensurate with skills and experience, we apply wage distribution data to create three skill groupings within each occupation. Jobs in the lowest pay quartile represent lower-skill or early-career jobs. Jobs in the highest pay quartile represent high-skill or later-career jobs. Jobs with wages between the 25th and 75th percentile represent middle-skill or mid-career jobs.

Table 1 compares the midpoints of pay ranges for Iowa and U.S. manufacturing jobs within each occupation-by-skill group after adjusting for cost-of-living differences.

Table 1. Typical Manufacturing Pay by Occupation and Job Level: Iowa and U.S., 2015



* Salary data for this analysis were obtained from the U.S. Bureau of Labor Statistics Occupational Employment Survey and were adjusted for cost-of-living differences using U.S. Bureau of Economic Analysis regional price parities.

Low-skill/Early-career Jobs

For lower-level manufacturing jobs, Iowa exceeds typical U.S. pay levels in several categories. Production, sales, maintenance-related, and transportation-related positions pay 10 percent or more than the U.S. benchmark. Salaries for lower-level

office and administrative roles exceed the national benchmark by more than 5 percent.

Iowa's salaries for the lowest tier of engineering and computer and mathematical positions are very near national values. For management and business and financial positions,

however, Iowa's lower-level positions pay about 95 percent of comparable U.S. values.

Middle-skill/Middle-career Jobs

For mid-level manufacturing jobs, we begin to see a divergence between occupation groups requiring lower versus higher levels of educational attainment. Salaries for mid-level production jobs in Iowa slightly exceed comparable U.S. values. Jobs in sales, office, and maintenance-type occupations pay salaries that are very near national values. While these kinds of jobs may necessitate education beyond high school, they generally don't require a bachelor's degree or higher.

In contrast, typical mid-level engineering, computer and mathematical, business and financial, and management positions in Iowa pay approximately 90 percent of U.S. levels.

Higher-skill/Later-career Jobs

Gaps in Iowa's pay levels are most apparent in the top quartile of jobs for each occupation group. Typical pay levels fall below 95 percent of national values for high-level production, sales, office, and maintenance-related jobs. Worse, the pay ratio for higher-level engineering, computer and mathematical, and business and financial jobs is about 85 percent or less. Data for top-tier management positions are not available.

Iowa's wages appear most competitive for lower-skill and early-career manufacturing jobs. As the skill, experience, or educational content of jobs increases, Iowa's pay levels begin to lag. This dynamic bodes ill for the state's ability to entice skilled workers into manufacturing jobs. It may also inhibit efforts to nudge Iowa toward higher-value and more innovative manufacturing activities.

As Iowa looks to boost the competitiveness of its manufacturing sector, monitoring wage gains for targeted job types rather than tracking average pay by firm or industry may better indicate progress. In particular, relative wage gains for mid-level and higher-level manufacturing jobs might indicate success in building the leadership capacity required to drive innovation efforts.

Seeking Definitive Information about Iowa Industry?

CIRAS each year publishes a Manufacturing in Iowa report featuring detailed economic statistics.

Visit www.ciras.iastate.edu.

Look closely at Iowa's rolling landscape and you may be surprised to discover what is made here. Companies here create everything from machinery and pastry to software and bridges. Each issue, CIRAS News provides a sampling of some of the Iowa businesses you can support.

ImageFirst Creative Sign

Overview: ImageFirst is an architectural wholesale sign manufacturer. They specialize in custom fabricated aluminum and steel exterior signage. They have more than 30 years of experience in the signage industry.

Location: Grinnell, Iowa

Founded: 2001

Employees: 20

Website: www.imagefirstsigns.com



Clarion Packaging, LLC

Overview: Clarion Packaging, LLC, is a pulp molding company that manufactures egg cartons, egg trays, and four-cup drink carriers made out of recycled newspaper. Their egg-packaging customers include egg-packing facilities across the United States, and they make the four-cup drink carriers for a major fast food restaurant chain.

Location: Clarion, Iowa

Founded: 2005

Employees: 100



Woodruff Construction, LLC

Overview: Woodruff Construction, an award-winning commercial general contractor, has built projects all over the state, including health care, school, office, retail, industrial, warehouse, and production facilities. By employing its own skilled workforce to perform concrete, carpentry, steel, and crane operations, the company is able to keep costs down and increase efficiency and safety on the job site.

Location: Ames, Fort Dodge, Iowa City, and Waterloo, Iowa

Founded: 1956

Employees: 161

Website: www.woodruffcompanies.com



A Sample of CIRAS Knowledge

CIRAS' mission is to improve Iowa industry through research-proven best practices. To do that, we have to stay up to date on what's out there and what works. Here are a few things we learned in 2016.

Trade shows are a good testing ground. I can learn the latest developments, discuss them firsthand with Iowa companies, and quickly understand whether or not a given technology will be an effective tool. Last May we attended the RAPID conference in Orlando, which featured various 3D printing technologies designed to help manufacturers create better products and services, in a shorter time, while using fewer resources. However, many Iowa companies won't be able to take advantage of these advances because they lack foundational systems like computer-aided design (CAD). That's an important barrier that needs to be crossed.—*Chris Hill*

I learned from our national association of government contracting specialists that an artificial intelligence is working to understand my job. CIRAS contracting experts, along with our counterparts around the country, have been submitting questions to help teach nuance to Watson, IBM's artificial intelligence system famous for competing on "Jeopardy!" The goal is to develop a resource that one day will help government staffers and small companies quickly decipher the ocean of contracting rules.—*Jodi Essex*

I attended a symposium in Detroit last spring that partly focused on the "Internet of Things," a coming wave of connectivity that will change the way manufacturers do business.

Iowa companies face a tenuous future if they don't develop 3D design, add sensors and smart devices to their products, and integrate all the various portions of their businesses. Companies that do this in the digital realm will be much better able to navigate the future and come out ahead.—*Paul Dunnwald*

I work in the CIRAS Technology Assistance Program (TAP), where we set up research collaborations with Iowa State University faculty. One new service that we utilized in 2016 is the Center for Survey Statistics and Methodology (CSSM). CSSM employees, working through CIRAS, can assist Iowa companies with designing consumer surveys, collecting data, and analyzing it. It's good information for companies trying to make strategic decisions about products they're selling to the public.—*Brian Muff*

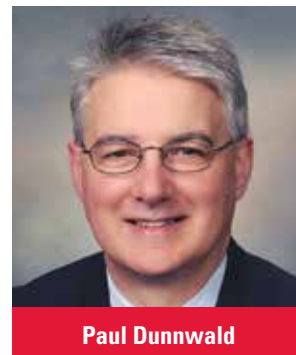
Many CIRAS clients get hung up in the weeds trying to accurately capture and calculate costs in order to develop a price for a new product without fully understanding how it will affect their bottom line. There are ways to use throughput accounting to grow sales and profits without needing to know the full product cost. I learned this at our Pricing & Quoting workshop in 2015, did some more research, and then tested the process with projects at two Iowa companies. It works.—*Mike Willett*



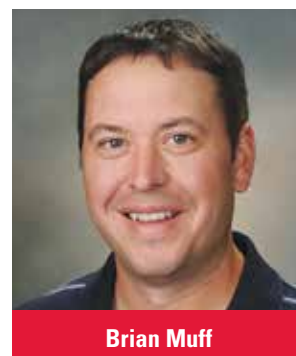
Chris Hill



Jodi Essex



Paul Dunnwald



Brian Muff



Mike Willett



B Fabulous BBQ Uses Government Contracts to Grow Gracefully

For one Iowa restaurant and catering business, the recipe for success so far has included a side of government contracts.

B Fabulous BBQ in Slater has cooked up nearly \$100,000 in business from public-sector clients over the last two years, said Deanna Faubus, who owns the company with her husband, Billy. “For a small joint like us, that’s a significant amount of sales.”

Catering meals for government-based organizations such as Camp Dodge in Johnston has provided welcome additional revenue as the company evolves. B Fabulous BBQ began as a catering business, then added a small deli within a Huxley grocery store that later became a restaurant. The enterprise moved to Slater at the end of 2016.

B Fabulous at first was a sideline business, using borrowed church kitchens to feed guests at weddings and other gatherings of Billy and Deanna’s friends and relatives. “Before we knew it, we were busy all the time,” Billy said.

In 2015, when the Huxley restaurant was still new, Deanna attended a CIRAS-sponsored vendor fair at Iowa State.

“Barbecue and catering is kind of seasonal, and so we were seeing this major slump in the winter,” she said. “We thought that government contracts would be an opportunity to have some more consistent catering throughout the year.”

CIRAS helped Deanna fill out forms and learn about bidding, said government contracting specialist Mary Zimmerman. Providing meals for government groups can be complicated, she said, because menus are very detailed, with portions specified exactly. “We tried to figure out every nuance so she wouldn’t miss something.”

“Government contracts can be very intimidating,” Deanna said. “There can be a lot of hoops. CIRAS has been able to just walk me right through that and show me that it’s not scary, and it’s not difficult.”

SAM Serves as Key Step in Gov Sales *by Mary Zimmerman*

The government must keep going, in good times and in bad.

Many small businesses that are involved in government contracting have learned that this stability means federal, state, and local government agencies can be a tremendous and steady source of income. And it’s a market that exists for more than just major-league defense contractors. Small business owners are sometimes astonished when they realize they are capable of supplying a product or service that the government needs.

To capitalize on potential government opportunities, Iowa businesses should register first at local agency websites. But they also should consider registering with the federal System for Award Management, or SAM, which is a government-run database that serves as a central registration site and is utilized by every federal agency, both civilian and military. The registration is free, and it’s easy.

Having the following information prior to registration will speed the process:

- Dun & Bradstreet DUNS number:
fedgov.dnb.com/webform
- Employer Identification Number (EIN)
- North American Industry Classification System (NAICS) Code(s): www.census.gov/eos/www/naics

To get started, access the SAM website (www.sam.gov) and click on “Create A User Account.”

It can take anywhere from one to three hours to complete the registration. When approved, you will be assigned your own CAGE (Commercial and Government Entity) code, which provides a standardized method of identifying a given legal entity at a specific location.

Your password will need to be renewed every six months and your SAM registration every twelve.

This is one of the key steps to get started in government contracting. If it all sounds intimidating, reach out to one of the government contracting specialists with CIRAS’ Procurement Technical Assistance Program (PTAP). We welcome the opportunity to guide your business through the registration process, because we pride ourselves on being the best resource available to help you compete successfully in the government marketplace.

➤ **For more information, contact Mary Zimmerman at maryz@iastate.edu or 515-450-1278.**

Iowa Vendor Conference to Share Knowledge, Strategies for Government Contracting

Representatives of more than 150 Iowa businesses are expected to pack the Iowa Events Center in Des Moines this summer for CIRAS' fourth annual Iowa Vendor Conference, a massive gathering designed to provide answers and advice for anyone pondering a future in government contracting.

Attendees at the August 10 conference will be able to hear presentations from national experts, ask speakers questions, and network with a host of vendors and representatives of government agencies.

The event will feature a keynote speech by Gloria Larkin, president of TargetGov and a nationally known speaker, author, trainer, and expert in federal contracting business development. Larkin will be leading two different sessions: "Why Selling to the Government Is Different Than Selling to the Private Sector" and "Effective Strategies for Competing in the IT Market."

Other presenters will include Guy Timberlake (photo above), chief visionary officer and CEO of The American Small Business Coalition, and Stephanie Zink, president of the Taurus Group, a woman-owned consulting group based in the Washington, D.C., area.

Last year's conference drew roughly 180 Iowa businesses, including Larry Eason, owner of Cedar Rapids-based Larry's Landscaping, who praised the conference as a valuable networking tool.

"You have to position yourself," Eason said. "If you don't come out, you don't know what's going on."

➤ For more formation, visit <http://register.extension.iastate.edu/ivc>.



■ **Subcontracting Opportunities**
May 18, 2017
9:00 a.m. to 10:30 a.m.
Webinar

■ **3D Printing's Current and Future Impacts on Manufacturing**
June 8, 2017
9:00 a.m. to 2:30 p.m.
Ames

■ **Reviewing Solicitations for Success**
June 23, 2017
8:30 a.m. to 10:30 a.m.
Bettendorf

■ **What Is the Goal?**
July 11, 2017
9:00 a.m. to 3:00 p.m.
Council Bluffs

■ **GovCon Networking Group**
July 26, 2017
10:00 a.m. to 11:00 a.m.
Iowa City

For more information on these and other similar events, please visit www.ciras.iastate.edu/events.asp.

STAFF NEWS



Michelle Thorn—Fiscal Support Coordinator/Accountant

Michelle Thorn joined CIRAS as a fiscal support coordinator/accountant. She handles employee reimbursement requests and assists with grant management for two programs. Thorn, who grew up in Pomeroy, previously served as a contract administrator/accountant for Juvenile Court Services and worked for the Story County Clerk of Court. Her hobbies include traveling with friends and family and watching college football and basketball.



Mark Williamson—Project Manager

Mark Williamson is a project manager for CIRAS, specializing in the use and implementation of digital design tools, manufacturing for assembly and design, and additive manufacturing. He is from Wiota and holds a bachelor's degree in mechanical engineering from Iowa State University. Williamson previously worked for Innovative Lighting in Roland, Smart Retract in Dubuque, and Electrolux Home Products in Webster City. Among other things, he enjoys designing and building games for tailgating activities at Iowa State football games.



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Since 1963, we have delivered proven services to enhance the performance of industry. Our approach—Engage. Educate. Embed.—creates specific solutions that allow each business and its community to prosper and grow. Coupled with a satisfaction guarantee, our typical client has achieved a 200% ROI. Clients have reported an economic impact of more than \$2 billion over the past five years.

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Alexander, Andrew L.	402-547-0333	andyalex@iastate.edu	Council Bluffs		●	●	●		
Bangalore, Savitha	515-294-5240	savitha@iastate.edu	Ames						●
Barton, Leah M.	515-291-0733	bartonl@iastate.edu	Ames						●
Berge, Paul	515-294-5972	pmberge@iastate.edu	Ames					●	
Boesenber, Adam J.	515-294-5903	aboesenb@iastate.edu	Ames					●	
Burant, Melissa M.	563-726-9958	mmburant@iastate.edu	Bettendorf		●	●	●		
Clark, Susan K.	319-329-9267	skclark@iastate.edu	Iowa City		●		●		
Colburn, Tina M.	515-509-5311	tcolburn@iastate.edu	Ames						●
Donald, Joy N.	319-359-0206	jdonald@iastate.edu	Iowa City		●	●			
Dunnwald, Paul	515-509-1377	dunnwald@iastate.edu	Urbandale	●					
Eckhoff, Jeff	515-231-7826	eckhoffj@iastate.edu	Ames						●
Essex, Jodi K.	515-509-0769	jodir@iastate.edu	West Des Moines		●	●	●		
Fagle, Julie A.	319-310-8612	jafagle@iastate.edu	Marion		●	●	●		
Galleger, Sean T.	515-290-0181	galleger@iastate.edu	Waterloo	●					
Gormley, Paul A.	319-721-5357	gormley@iastate.edu	Marion		●	●			
Hill, Chris H.	515-313-8251	chhill@iastate.edu	Ames					●	
Kelch, Laurel M.	515-294-5472	lmkelch@iastate.edu	Ames						●
Martin, Brenda	515-570-5282	bkmartin@iastate.edu	Ames	●					
Mohr, Jeff	515-450-7639	jeffmohr@iastate.edu	Ames		●		●		
Muff, Brian J.	515-520-1033	bmuff@iastate.edu	Denison					●	
Novak, Carey E.	515-408-4257	cenovak@iastate.edu	Ames					●	
O'Donnell, Michael R.	515-509-4379	modonnll@iastate.edu	Ames		●			●	
Poe, Jim R.	515-290-1398	jrpo@iastate.edu	Ames				●	●	
Prusko, Rudy	563-599-0645	rprusko@iastate.edu	Dubuque				●		
Reinig, Mark E.	515-231-4150	mreinig@iastate.edu	Elkader	●	●				
Roberts, John	515-294-0932	jarobert@iastate.edu	Ames					●	
Russenberger, Pamela	515-509-7814	plrussen@iastate.edu	West Des Moines		●	●	●		
Schneider, Marc A.	563-221-1596	maschn@iastate.edu	DeWitt			●	●		
Srinivasan, Shankar	515-290-6702	srigshan@iastate.edu	Ames			●		●	
Thach, Christopher A.	515-294-7731	cthach@iastate.edu	Ames						●
Thompson, Derek L.	515-419-2163	thompson@iastate.edu	Boone	●					
Thorn, Michelle	515-294-1316	mthorn@iastate.edu	Ames						●
Volkman, Glenn	515-205-3786	gvolkman@iastate.edu	Grinnell	●					
White, Beth	563-370-2166	whiteb@iastate.edu	Bettendorf		●	●	●		
Willett, Michael	319-240-2488	mwillett@iastate.edu	Waterloo				●		
Williamson, Mark	515-509-7024	mdwmson@iastate.edu	Ames					●	
Zimmerman, Mary J.	515-450-1278	maryz@iastate.edu	Ames		●	●	●		

CIRAS PARTNERS

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IOWA STATE UNIVERSITY

Office of Economic Development and Industry Relations

College of Engineering

Center for Industrial Research and Service

1805 Collaboration Place, Suite 2300

Ames, Iowa 50010-9166



www.ciras.iastate.edu

INNOVATION

What We've Learned After a Year of Owning an Additive Manufacturing Machine

by Chris Hill

CIRAS is more than a full year into our metal Additive Manufacturing (AM), or 3D printing, efforts, and the year has been a busy one. We had three fundamental goals when our program began: build awareness, increase knowledge through projects, and provide access to students. We have succeeded at all three and learned a great deal while bumping through, and sometimes into, the limits of this cutting-edge technology.

Our educational events and counseling sessions over the past year have reached more than 500 people, and we continue to spark additional interest with a LabTour series that allows companies to come to Iowa State University and see the system firsthand four times a year.

We now have numerous projects with companies in the areas of R&D, manufacturing process (jigs, fixtures, molds), and service parts. The plastic molding industry has shown increasing interest in our projects. We spent the latter part of the year developing methods to create metal AM-produced plastic injection molds that can compete with traditional processes.

We started the year with plans to complete 1,000 hours of build time. We exceeded 3,000 hours. Strong demand

has allowed us to discover issues with the system, and we worked with the equipment manufacturer to address and minimize negative impacts. Our system has seen numerous upgrades as we continue to push the envelope.

We have three students heavily engaged in running the system, and all will be great assets to companies after graduation. Faculty also have started bringing classes into the lab, and we are supporting development of class curriculum around this technology.

As we enter our second year, we continue to see strong interest from companies. Metal AM system manufacturers are working hard to improve and enhance future systems. Bigger, faster, more accurate, and less expensive systems will continue to drive industry interest in this technology.

It's been a fun and challenging year. We have failed, learned, and succeeded in many areas, and we have only started our journey. Please contact CIRAS if you'd like help understanding how this technology could support your company's objectives.

For more information, contact Chris Hill at chhill@iastate.edu or 515-294-5416.